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but shows that there can be no middle ground between the common estimate of the plant and that which a logical interpretation of all the facts now disclosed forces upon us.

Each successive season a fresh series of analyses and practical tests were made and put upon record, beginning with that stage of the development of the plant, when the percentage of cane sugar had previously been supposed to have reached its maximum, and extending them through the after period of juice-ripening, brought on by the timely separation of the immature grain, up to the time of frost. It was found that the saccharine strength of the juice, under the new conditions, constantly increased in a fixed ratio, and that the life of the plant was prolonged from a month to two months beyond the natural period.

(To be continued.)

THE ASTRONOMICAL EXHIBITS AT THE WORLD'S FAIR.

THE Astronomical Exhibits at the World's Fair at Chicago represent fairly well the present state of the science of astronomy. But they are scattered about in the various buildings so as to make it difficult even to find them all, to say nothing of systematic study and comparison of them one with another. In a general way, the most important astronomical displays are to be found among the educational exhibits, which are located in the west and south galleries of the Manufactures and Liberal Arts Building. In the exhibit of Harvard University, in the south gallery, is a splendid collection of astronomical photographs made by the Harvard College Observatory. Especially interesting are several photographs of stellar spectra and of nebulae and clusters. One photograph of a portion of the moon's disk represents an enlargement of over one thousand diameters. Nowhere else can be found a better illustration of the great usefulness of photography in astronomy. The collections of Draper and Langley are to be found in the exhibits of the University of the City of New York and of the Western University of Pennsylvania. The four-inch almacantar, which is the first one constructed and used by Dr. Chandler, is in the exhibit of De Pauw University. The exhibit of Johns Hopkins University contains a fine collection of diffraction gratings and photographs of spectra by Professor Rowland. In the German Educational Exhibit, in the west gallery, are specimens of the famous Jena optical glass, the original spectroscope of Kirchhoff, and some fine mathematical models by Brill. Here is also shown the magnetic apparatus of Gauss and Weber. Near by, in the English Exhibit, is the display of the Royal Astronomical Society, containing a large number of astronomical photographs by Roberts, Gill and Abney, and still others from the Royal Observatory at Greenwich. Boedicker's drawings of the Milky-way and Dr. Common's five-foot glass speculum are in the English exhibit. The latter is unsilvered and has evidently been placed with greater care to secure safety than visibility. In the Swiss Exhibit, in the main aisle of the Manufactures Building, is a display of instruments by La Société Genevoise.

The exhibits of the American makers of astronomical instruments are in the north gallery of the Manufactures Building, just over the main aisle. Warner and Swasey show a fine twelve-inch equatorial telescope, with smaller instruments, and also the mounting of the great forty-inch Yerkes telescope, which is set up at the north end of the main aisle. The appearance of the great telescope gives an impression of symmetry and strength. The lens for it is being made by Alvan Clark & Sons, of Cambridgeport, Mass. They report satisfactory progress, but say that it

will not be finished for a year or more. The Clarks, by the way, make no exhibit at Chicago. J. A. Brashear, of Allegheny, Pa., exhibits the stellar spectroscope for the Yerkes telescope. He also shows an eighteen-inch and a fifteen-inch objective, gratings, specula, etc. G. N. Saegmuller, of Washington, exhibits a variety of instruments of precision, among which are a nine-inch equatorial telescope and a four-inch steel meridian circle. The exhibit of the Gundlach Optical Company also deserves mention. The American instrument-makers, as a whole, make a most creditable showing. The displays of the foreign instrument-makers are, many of them, located in the Electricity Building. Schott und Genossen, of Jena, show a large number of specimens of optical glass, and among them are two twenty-three-inch discs of the celebrated Jena glass. Merz, of Munich, shows two equatorial telescopes and several telescopic objectives, the largest of which is ten inches in diameter. The Repsolds, of Hamburg, seem not to be represented—a fact much to be regretted.

Dr. Gill's interesting stellar photographs are in the Cape Colony Exhibit in the Agricultural Building, and the Lick Observatory display is in the educational department of the California State Building, and is strangely enough mixed up with the kindergarten exhibit there.

The U. S. Naval Observatory Exhibit is a small observatory located northeast of the Government Plaza, and is in charge of Lieut. A. G. Winterhalter, U. S. N. There are a small equatorial telescope, photoheliograph and many smaller instruments. The Weather Bureau Exhibit, a short distance to the west, is well worth a visit. The exhibit of Coast Survey apparatus, in the U. S. Government Building, is full of interest, from the geodetic standpoint.

SCIENCE TEACHING IN SECONDARY AND PRIMARY SCHOOLS.

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IT has long been a dream of scientists that the time would come when the elements of natural history and of the physical sciences would be taught in secondary and primary schools. To thinking people it does not seem necessary to argue that every boy should be instructed in the elements of chemistry, natural philosophy, botany, geology, zoölogy and physiology. To persons not teachers, it would seem no difficult matter to find a place in the school curriculum for the elements of the above sciences. But it remains true that they are not taught, or taught to such an extent, and in such a manner, as to produce results entirely worthless.

Why is this condition of things prevalent? Why, after all that has been said and written, is there is no change for the better? The answer seems to be this: The elements of the sciences are not taught in elementary and primary schools for the reason that the teachers themselves have never been taught, and without instruction they feel that to attempt to teach these branches they would be blind leaders of the blind. More than this, the schools whose special duty it is to train teachers for primary and secondary schools, have not begun to do any real work in the line of science instruction. The sciences in these schools are so placed in the background that practically no training at all is given in them. It is then no wonder that the graduate of such a school does not feel capable of giving any instruction in even the elements of the sciences. To demonstrate the above statements the catalogues of the Pennsylvania State normal schools will be examined, and certain results tabulated. It will be seen that the teachers of *arithmetic* and *grammar* far